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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/050,195

01/16/2002

Sang-Bom Kang

5649-912

6301

20792

7590

05/31/2006

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EXAMINER

IM, JUNGHWA M

ART UNIT

PAPER NUMBER

2811

DATE MAILED: 05/31/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

<b>Office Action Summary</b>	<b>Application No.</b> 10/050,195	<b>Applicant(s)</b> KANG ET AL.	
	<b>Examiner</b> Junghwa M. Im	<b>Art Unit</b> 2811	/

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

**Period for Reply**

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

**Status**

- 1) ☒ Responsive to communication(s) filed on 01 May 2006.
- 2a) ☐ This action is **FINAL**.                      2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

**Disposition of Claims**

- 4) ☒ Claim(s) 1-14 and 25-32 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1-14 and 25-32 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

**Application Papers**

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 16 January 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

**Priority under 35 U.S.C. § 119**

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All    b) ☐ Some \* c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- \* See the attached detailed Office action for a list of the certified copies not received.

**Attachment(s)**

- |   |   |
|---|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892)  | 4) <input type="checkbox"/> Interview Summary (PTO-413)<br>Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948)  | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152)             |
| 3) <input checked="" type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)<br>Paper No(s)/Mail Date <u>5/2006</u> | 6) <input type="checkbox"/> Other: _____  |

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

A request for continued examination under 37 CFR 1.114 was filed in this application after a decision by the Board of Patent Appeals and Interferences, but before the filing of a Notice of Appeal to the Court of Appeals for the Federal Circuit or the commencement of a civil action. Since this application is eligible for continued examination under 37 CFR 1.114 and the fee set forth in 37 CFR 1.17(e) has been timely paid, the appeal has been withdrawn pursuant to 37 CFR 1.114 and prosecution in this application has been reopened pursuant to 37 CFR 1.114. Applicant's submission filed on May 1, 2006 has been entered.

### ***Information Disclosure Statement***

The information disclosure statement filed May 1, 2006 has been considered.

### ***Claim Rejections - 35 USC § 102***

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

1. Claims 1 and 3-5 are rejected under 35 U.S.C. 102(b) as being anticipated by Chang et al. (US 5,672,542), hereinafter Chang.

Regarding claim 1, Fig.1 of Chang shows a semiconductor device comprising a substrate 10, an insulating layer 20 disposed in a gap on the substrate, a liner layer 26 exhibiting

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compressive stress (col. 1, lines 32-33), a contact plug 28 exhibiting tensile stress (col. 1, lines 53-54) directly on the liner layer.

Regarding claim 3, the liner of Chang inherently possesses an amorphous structure since it is deposited by CVD.

Regarding claims 4-5, Fig. 1 of Chang shows an ohmic layer, Ti 24 between the liner and the insulating layer.

### ***Claim Rejections - 35 USC § 103***

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

2. Claims 2 and 8-10 are rejected under 35 U.S.C. 103(a) as being unpatentable

over Chang in view of Taguwa et al. (US 6,107,190), hereinafter Taguwa.

Regarding claim 2, Chang discloses substantially the entire claimed device including a TiN liner layer except a TiN contact plug. Taguwa discloses in Fig. 1D a TiN contact plug 84 exhibiting tensile stress (col. 2, lines 33-39). It would have been obvious to one of ordinary skill in the art at the time of the invention to form a TiN plug in the device of Chang with Taguwa's teaching since TiN is an art recognized equivalent of the plug material disclosed in Chang.

Regarding claims 8-10, Fig. 1D of Taguwa shows an aluminum wiring layer 85 (col.3, line 18).

3. Claims 11-13 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chang in view of Moise et al. (US 6,534,809), hereinafter Moise.

Regarding claims 11-13, Chang discloses substantially the entire claimed device except a capacitor structure on the contact plug. Fig.1 of Moise shows a capacitor 125 formed on a contact plug 114 and a capacitor with a lower electrode 124 made of Pt (col. 9, lines 27-39). It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate Moise's teaching to Chang's device in order to fabricate a DRAM array with a charge storage capacitor.

4. Claim 14 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chang in view of Nagasaka et al. (US 6,300,683), hereinafter Nagasaka.

Regarding claim 14, Chang discloses substantially the entire claimed device except a shape of the contact plug. However, Fig. 19D of Nagasaka shows a tapered contact plug 12. It would have been obvious to one of ordinary skill in the art at the time of the invention to form a tapered contact plug of Chang with Nagasaka's teaching in order to form the plug without cracks. It is well known in the art that it is easier to fill contact/plug openings with tapered sidewalls.

5. Claims 25-29, 31 and 32 are rejected under 35 U.S.C. 103(a) as being unpatentable over Chang and Taguwa as applied to claim 2 above, and further in view of Moise.

Regarding claim 25, Fig.1 of Chang shows a contact plug in an insulating layer 20 having tensile stress (col. 1, lines 53-54), a TiN layer 26 surrounding the plug on contact and having compressive stress (col. 1, lines 32-33) and an ohmic layer 24 between the insulating layer and

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the TiN layer.

Chang discloses substantially the entire claimed device except a TiN plug. Taguwa teaches a TiN plug having a tensile stress (col. 2, lines 33-39) in lieu of W plug of Chang. It would have been obvious to one of ordinary skill in the art at the time of the invention to form a TiN plug in the device of Chang with Taguwa's teaching in order to reduced a production cost as taught in column 1, lines 57-61 of Taguwa.

The device with the teachings of Chang and Taguwa fails to show that a lower electrode of the capacitor structure contacting the upper surface of the TiN plug. Fig.1 of Moise shows a bottom electrode 124 of a capacitor 125 formed on a TiN contact plug 114 (col. 7, lines 43-50). It would have been obvious to one of ordinary skill in the art at the time of the invention to incorporate Moise's teaching to the device of Chang and Taguwa in order to fabricate a DRAM array with a charge storage capacitor.

Regarding claim 26, Taguwa discloses a TiN plug formed by CVD (col.1, lines 57-61).

Regarding claim 27, Chang discloses a TiN layer formed by CVD (col. 3, lines 13-14). In addition, CVD, ALD, CVD AND ALD are a process designation and would thus not carry patentable weight in this claim drawn to a product. See *In re Thorp*, 227 USPQ 964 (Fed. Cir. 1985).

Regarding claim 28, Chang discloses a TiN layer has an amorphous crystal structure since it is deposited by PVC.

Regarding claim 29, Chang discloses a TiN liner formed by physical vapor deposition (col. 3, line 13). In addition, IPVD is a process designation and would thus not carry patentable weight in this claim drawn to a product. See *In re Thorp*, 227 USPQ 964 (Fed. Cir. 1985).

Regarding claim 31, Moise shows the upper conductive layer made of Pt (col.9, lines 30-33).

Regarding claim 32, Moise shows the upper conductive layer (51) comprising a lower electrode of a capacitor (col. 9, lines 27-29).

6. Claim 30 is rejected under 35 U.S.C. 103(a) as being unpatentable over Chang, Taguwa and Moise applied to claim 25 above, and further in view of Nagasaka.

Regarding claim 30, the device with combined teachings of Chang, Taguwa and Moise shows substantially entire claimed structure except a tapered contact plug. Fig. 19D of Nagasaka shows a tapered contact plug 12. It would have been obvious to one of ordinary skill in the art at the time of the invention to form a tapered contact plug of Chang with Nagasaka's teaching in order to form the plug without cracks. It is well known in the art that it is easier to fill contact/plug openings with tapered sidewalls.

7. Claims 6 and 7 are rejected under 35 U.S.C. 103(a) as being obvious over Chang.

Regarding claim 6, Chang does not explicitly disclose the thickness of the ohmic layer as claimed. However, it would have been obvious to one of ordinary skill in the art at the time of the invention to have the recited range of the thickness for an ohmic layer to improve the conductivity, since it would have been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only in routine skill in the art. *In re Aller*, 105 USPQ 233.

Regarding claim 7, Fig. 1 of Chang does not explicitly show the thickness of the liner layer as claimed. However, it would have been obvious to one of ordinary skill in the art at the

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time of the invention to have the recited range of the thickness for an liner layer to enhance the adherence, since it would have been held that where the general conditions of a claim are disclosed in the prior art, discovering the optimum or workable ranges involves only in routine skill in the art. *In re Aller*, 105 USPQ 233.

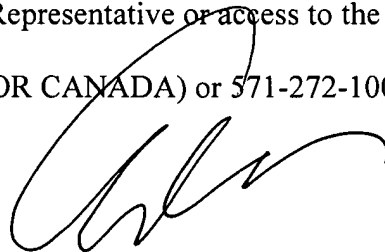
### ***Conclusion***

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Junghwa M. Im whose telephone number is (571) 272-1655. The examiner can normally be reached on MON.-FRI. 8:30AM-5:00PM.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Eddie C. Lee can be reached on (571) 272-1732. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

jmi



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